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Comparing Bulk and Can Milk Hauling Costs

by Joseph M. Cowden

FARMER COOPERATIVE SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE
FCS Circular 14
June 1956

THE Farmer Cooperative Service conducts research studies and service activities of assistance to farmers in connection with cooperatives engaged in marketing farm products, purchasing farm supplies, and supplying business services. The work of the Service relates to problems of management, organization, policies, financing, merchandising, product quality, costs, efficiency, and membership.

The service publishes the results of the studies; confers and advises with officials of farmer cooperatives; and works with educational agencies, cooperatives and others in the dissemination of information relating to cooperative principles and practices.

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This study was conducted under authority of the Agricultural Marketing Act of 1946 (RMA Title II).

CONTENTS

Page

Highlights v
Comparing bulk and can routes 2
    Truck operating costs 2
    Time requirements 3
Best chance of savings 4
    Every-other-day service 4
    Large producers 5
    Long routes 7
Applying savings to farm tank costs 8
    Cost of farm tank 8
    Savings and total investment 9
    Savings and added investment 10
Coordination—a challenge to management 12
    Advanced planning 12
    Route efficiency 12

HIGHLIGHTS

- Substitution of bulk milk procurement methods for customary methods of hauling milk in cans offers opportunities for substantially reduced farm-to-plant milk transportation costs in many fluid milk markets. A survey of two midwestern cooperatives leads to this conclusion.

- Under specified conditions representative of those in many areas, a can truck traveled 1 mile for each hundredweight of milk hauled compared to .86 mile and .57 mile on the daily bulk and every-other-day bulk routes, respectively. This reduced mileage requirement meant a savings in truck operating cost of 3 to 5 cents per hundredweight by converting to bulk pickup.

- The average farm stop time on two bulk routes was 6.8 minutes per loading stop plus .35 minute per hundredweight of milk loaded. On two can routes the average farm stop time was 1.45 minutes per stop plus .46 minute per can loaded.

- Potential savings are greatest when relatively large volume producers are served by the bulk routes. Substantial savings are possible, however, when the average daily production per farm ranges from 300 to 500 pounds, a level typical of fluid milk markets today.

- Bulk hauling costs were lower compared to can hauling costs on long routes than on short routes.

- Best chances for savings occur when bulk trucks serve each farmer *every other day*. Reductions in hauling costs on bulk routes providing *daily* pickup service are not probable in serving producers of the size prevailing in most midwestern and eastern markets.

- Cost advantage of every-other-day bulk hauling increased rapidly up to an average of about 350 pounds per patron a day and slowly thereafter. At 350 pounds of milk a day, can hauling costs were a little over 23 cents per hundredweight compared to 17.4 cents for bulk hauling. When patrons averaged 700 pounds a day, with all other factors remaining the same, costs decreased to slightly less than 22 cents on the can route and 15.3 cents on the every-other-day bulk route.

- *Daily* bulk hauling costs exceeded can hauling costs until average production per patron reached 500 pounds per day.

- At the 200-pound a day level, potential savings over a 15-year period on every-other-day pickup equaled about one-fifth of the farmer's *total* investment in a bulk tank. On routes serving patrons who averaged 1,000 pounds of milk a day, the estimated saving in hauling costs equaled nearly three-fourths of the cost of the producers' investment in bulk tanks.

- With producers averaging 600 pounds or more a day on every-other-day bulk routes, the estimated saving in hauling over a 15-year period would more than repay such producers for their entire *added* costs resulting from converting from cans to bulk tanks. The smaller savings from daily bulk service would cover a substantial part of the added costs when producers average 900 pounds or more milk a day.

- Besides its effects on the costs of hauling—discussed in this report—converstion from can to bulk handling may also result in savings from smaller losses of milk solids, improved quality, reduced labor and equipment needs in plant receiving rooms, and other advantages of bulk handling. Additional expenses—such as those of improving farm driveways and for operating the cooling equipment from day to day—may be incurred.

- Bulk routes need to be efficiently organized and operated to produce maximum savings. During the conversion period, it is important that these routes be flexible. Otherwise, interweaving bulk routes will increase bulk hauling costs.

- Adroit management will be required, however, if anything like the full potential in reduced hauling costs is to become a reality. Solving problems associated with organization of bulk routes and reorganization of can routes requires careful planning.

Comparing Bulk and Can Milk Hauling Costs

by Joseph M. Cowden

Dairy Branch

Marketing Division

Producers, milk receiving plants and milk haulers in all sections of the country are adopting bulk milk handling methods. Surveys conducted by the Farmer Cooperative Service indicate that nearly 18,000 farms in 46 States were equipped with bulk tanks in March 1955 as compared to about 6,000 farms in 30 States in May 1953.

The change from customary methods of hauling milk in cans to bulk methods of handling requires substantial increases in investments in equipment. These costs fall mainly on producers and secondarily on owners of transportation facilities.

Obviously the dairy industry would not be adopting this new method unless it anticipated advantages which would offset the additional costs.

Reduction in farm-to-plant transportation costs is one of the principal advantages generally associated with bulk methods. Before a producer buys a farm bulk tank he needs to know how much hauling costs may be reduced. Haulers also need this information. It also is necessary for managers and other officials of milk receiving firms who direct and coordinate the necessary reorganization of the milk procurement system.

The Farmer Cooperative Service has attempted to determine the extent and the nature of the potential reductions in hauling costs by comparing can and bulk hauling operations of two midwestern cooperatives. This circular reports the results of these cost comparisons and estimates the amount and significance to producers of potential cuts in hauling costs due to or associated with bulk handling. It also considers some of the problems involved in reorganization of route systems.

The study covered only the milk transportation phase of procurement operations. We did not attempt to analyze the overall impact of bulk procurement on producers, milk receiving plants or market areas. Limiting the scope of this study, however, does not imply that the potential reduction in hauling costs is the only factor to be considered in deciding whether or not to adopt bulk collection methods. Actually hauling costs are but one of many factors to be considered, with several others probably of equal or greater significance in the long run.

Bulk hauling operations included in this study represented the initial bulk

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milk collection experience of each of the two cooperating plants. Detailed time, mileage, and operating cost records for a six-month period were obtained for three bulk trucks and 2 can trucks.

Direct comparisons of actual route operations did not show the relative economies of the two systems of hauling. The bulk routes served the largest producers while the can routes served the remainder of the patrons in the area. Costs on the bulk and the can routes were thus not comparable.

From the actual operating data, however, we obtained measurements of time and mileage per hundredweight of milk hauled. These data were used to construct a series of model routes and estimate costs of serving each route by can, daily bulk and every-other-day bulk routes. On each of the model routes the average size of producers served and similar items affecting costs were the same irrespective of the method of hauling.

A typical can truck operation was compared with a typical bulk truck operation. For purposes of this comparison we selected the 125-can capacity can truck and the 1,500-gallon capacity tank truck, each hauling an average load of 80 percent of capacity. It was assumed that the bulk trucks hauled 2 loads a day while the can trucks hauled only 1 load.

This study thus compares can and bulk milk hauling costs when the bulk truck hauls a load 50 percent in excess of that of the can truck and hauls 2 loads a day as compared to 1 for the can truck.

If you are interested in details of how we made this study, and in the procedures and analysis used in arriving at conclusions, write to Dairy Branch, Farmer Cooperative Service, U. S. Department of Agriculture, Washington 25, D. C., and ask for a copy of FCS Service Report 18, "Farm-to-Plant Bulk and Can Milk Hauling Costs."

Comparing Bulk and Can Routes

Costs of operating milk routes may be broken down into 2 parts—truck operating costs and time or labor costs. Analysis of the actual route operations showed substantial differences between bulk and can route costs in each of these categories.

Truck Operating Costs

When bulk and can trucks were each operated 15,000 miles per year, operating costs for the bulk trucks were 21.5 cents per mile as compared to 15.7 cents for the can trucks.

The substantially higher cost per mile for the bulk trucks was due entirely to higher overhead costs. Although the average gross loaded weight of the bulk trucks was 22,000 pounds as compared to 20,000 pounds on the can trucks, there was little difference in direct costs. Average costs for gas, oil, tires and repairs were approximately 8 cents a mile for both types of trucks.

Annual overhead costs on the bulk trucks averaged $2,032—on the can trucks $1,125. This difference was due principally to the high initial cost of the tank trucks and necessary supplementary equipment as compared to the cost of can trucks. The average investment in the three bulk vehicles was $9,200 as compared to less than $3,600 in the can trucks.

Due to the higher ratio of fixed costs to variable costs, the total cost per mile of operating the tank trucks declined much more rapidly than that of the can trucks as the annual mileage increased. This relatively high overhead puts pressure on the bulk truck owner to make fuller use of trucks and

To offset higher operating costs of his bulk truck compared to a can truck, the bulk truck owner can reduce per mile and per hundredweight costs by making fuller use of his truck.

thus reduce per mile and per hundredweight costs on the bulk trucks to a level comparable to that on can trucks. Fortunately, bulk hauling methods are flexible enough to permit haulers to make such adjustments. As previously indicated, many bulk haulers are collecting more than one load of milk per day. Others are operating their trucks on an every-other-day service basis, thus reducing the mileage driven in collecting a load of milk.

Time Requirements

Time requirements per hundred pounds of milk hauled were in most cases higher on daily bulk routes than on can routes serving producers of the same size. Long routes and routes serving abnormally large volume producers were exceptions to the rule.

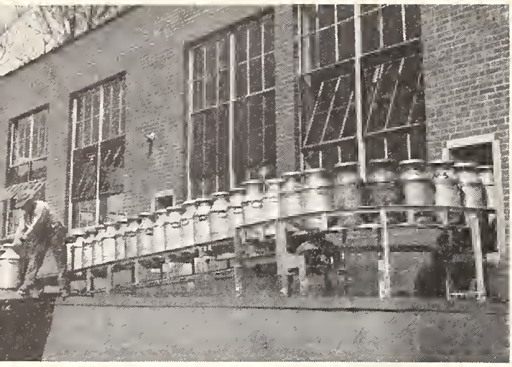
Although the bulk trucks spent more time at the plant—waiting, unloading, and being cleaned—than the can trucks, there was only a slight difference in the time at the plant per hundredweight of milk unloaded.

When distances between stops on the routes were comparable, bulk and can trucks traveled at approximately the same rate of speed. Since the bulk trucks carried larger loads on the over-the-road segments of the routes, they had a slight advantage in travel time per hundredweight of milk hauled.

Bulk trucks on the other hand required more time at the farm per hundredweight of milk loaded than did can trucks when production per farm was at levels typical of most of our fluid milk markets. This difference arises from the fact that the bulk hauler performs functions at the farm milk house which the can hauler does not. At ordinary volume levels the time required to measure and sample milk, rinse the tank, and perform other duties is more than that required to load an equal amount of milk in cans.

Other studies have indicated that bulk routes characteristically have high fixed time requirements per farm stop, with a comparatively low rate of increase in time as volume loaded increases. Low fixed time requirements and a relatively high rate of increase as volume loaded increases are typical of can route operations.

Our analysis of farm stop time requirements agrees with these results. The average farm stop time on the two more efficient bulk routes was 6.8 minutes per loading stop plus .35 minutes per hundredweight of milk loaded. On the two can routes the



Customary can receiving methods at the plant require a good deal more labor than the bulk method of handling milk.

average farm stop time was 1.45 minutes per stop plus .46 minutes per can loaded. The rate of increase in farm stop time on the can routes as volume increased was thus .66 minutes per hundredweight as compared to .35 minutes on the bulk routes.

The additional duties performed by the bulk hauler in addition to requiring more time are more technical in nature than those performed by the can hauler. In general they require a better trained and more reliable route operator. In estimating costs we have charged all labor on bulk routes at the rate of $1.50 an hour as compared to $1.35 an hour on the can routes.

Best Chance of Savings

Now to consider in more detail how high costs per mile and high costs per hour and per stop on bulk routes can be converted into low per hundredweight hauling costs to the producer. Every-other-day pickup appears the most logical answer. Quite naturally also potential savings are greatest when relatively large volume producers are served by bulk routes. And bulk hauling costs are lower compared to can hauling costs on long routes than on short ones.

Every-Other-Day Service

On daily bulk routes, lower hauling costs are not probable for average producers in most midwestern and eastern markets. Even when average production per farm is exceptionally high, the potential reduction in hauling costs is relatively small. Higher loading time typical of such routes almost entirely offsets the economies of larger loads and greater use of the trucks. While daily bulk route operations are undoubtedly practicable in some cases, they should not be expected to result in large reductions in average hauling costs.

Every-other-day bulk service on the other hand can reduce both mileage and time requirements on a per hundredweight of milk basis. Total hauling costs on efficiently organized every-other-day bulk routes are not only much lower than on daily bulk routes but in practically all cases substantially lower than on can routes serving comparable groups of producers.

When bulk routes are operated on an every-other-day basis, each dairy farm is served once in 2 days instead of daily. In other words the bulk truck covers half of the milk procurement area each day. The daily bulk truck and the can truck must cover the entire area each day.

Every-other-day bulk service can save up to 50 percent on the mileage of the pickup section of the route as compared to daily service by either bulk or can trucks. Maximum savings can be realized only when haulers can divide the pickup area mileage into 2 separate runs without duplication. Topography and the lack of connecting roads in many cases will make perfect division impossible and reduce savings below the maximum of 50 percent.

Every-other-day service also provides a practicable solution to the high farm stop time problem. The every-other-day hauler, by picking up 2 days' milk at each stop, cuts the farm stop time per 100 pounds of milk to about the time it takes to load the same amount of milk in cans.

Potential reductions in hauling costs on every-other-day bulk routes are greatest compared to can hauling costs when producers are large and relatively far apart and the pickup area is distant from the plant. The opportunity for saving is less when routes are short, patrons are small and located close together on the route.

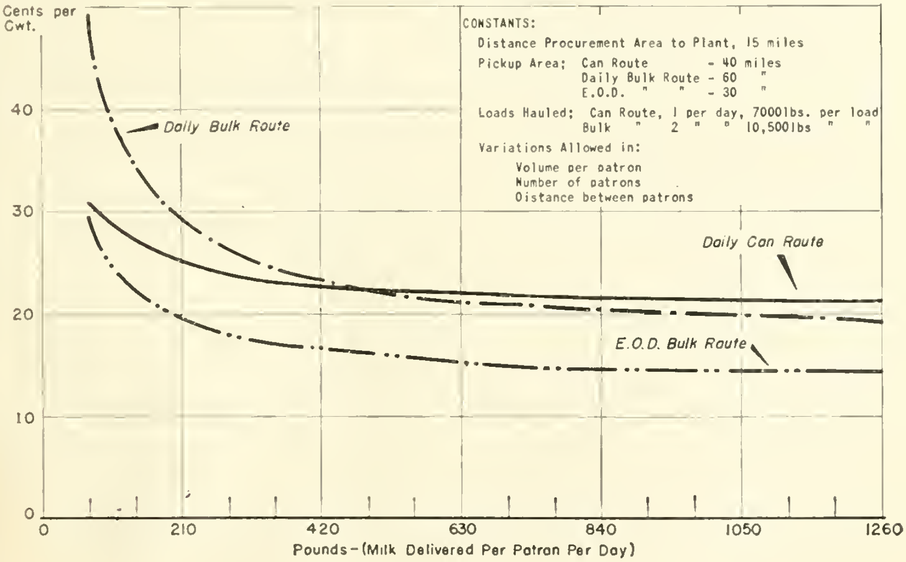
Large Producers

The rather widespread adoption of bulk handling methods is forcing many producers to make decisions about their future dairy operations. Many of them ask—"How much milk do I have to produce before a bulk tank will be a paying investment on my farm?" Many factors outside the scope of this circular must be taken into consideration to provide a complete answer to this question. Nevertheless this analysis does provide a partial answer.

Production of milk per farm does not need to be exceptionally high for every-other-day route operations to result in substantial reductions in hauling costs. A large part of the advantages of every-other-day bulk hauling are reflected in reduced costs at the 350 pound per day or average patron level. Larger savings result when the volume of milk sold per farm increases but the rate of increase in savings is relatively slight at above average volume levels. Potential reductions in hauling costs on routes serving patrons who average 300 to 500 pounds of milk a day are nearly as great as when patrons average 1,000 pounds a day.

These facts are illustrated graphically in figure 1. It shows how changes in the average daily volume per patron affect the costs of hauling milk on can, daily bulk, and every-other-day bulk routes.

Figure 1.—Costs of can and bulk milk hauling related to volume per patron served



The comparison is between a can truck hauling a 7,000 pound load of milk and bulk trucks each hauling 10,500 pound loads. Length of route and size of load hauled were held constant for each of the three types of routes. The daily bulk route is longer than the can route due to the larger load hauled. The pickup area of the every-other-day bulk route is only half as long as that of the daily bulk route since it loads twice as much milk per stop.

Under conditions shown in figure 1, the can truck traveled 1 mile for each hundredweight of milk hauled compared to .86 miles and .57 miles on the daily bulk and every-other-day bulk routes, respectively. Truck operating costs were nearly 12.5 cents per hundredweight of milk hauled on the can route, compared to about 9.5 cents on the daily bulk route and slightly more than 7 cents on the every-other-day bulk route.

When a truck travels the same number of miles to pick up the same amount of milk, its operating cost (exclusive of the driver's time) for each 100 pounds of milk would be expected to remain approximately the same, regardless of whether the patrons were large or small or of how many patrons were served. Thus, if no other factors were affecting costs as volume per producer increased, can hauling costs should always have been almost 3 cents higher than daily bulk costs and a little over 5 cents higher than every-other-day hauling costs for each hundredweight of milk hauled.

But figure 1 indicates that no such consistent relationship existed. Significant changes in the relationship between bulk and can hauling costs occurred as the daily volume per patron increased. At lower volumes, can hauling costs were much lower than daily bulk and only slightly higher than every-other-day bulk hauling costs. As volume per patron increased, however, total unit (hundredweight) costs on the bulk routes dropped much faster than on the can route. The cost advantage of every-other-day bulk hauling increased rapidly up to an average of about 350 pounds per patron a day and slowly thereafter.

When patrons averaged 350 pounds of milk a day, can hauling costs were a little over 23 cents per hundredweight compared to 17.4 cents on the every-other-day bulk route. When the patrons averaged 700 pounds a day, all other factors remaining the same, costs decreased to slightly less than 22 cents on the can route and 15.3 cents on the every-other-day bulk route. The advantage of every-other-day hauling for the patrons shipping 350 pounds was thus 5.7 cents compared to 6.6 cents for the producers shipping 700 pounds. At the 1,400 pounds per day production level, the advantage of every-other-day bulk hauling would be only 6.8 cents per hundredweight.

Daily bulk hauling costs exceeded can hauling costs until average production per patron reached 500 pounds a day. Above 500 pounds, daily bulk hauling had a slightly increasing cost advantage over can hauling under conditions depicted in figure 1. The cost advantage in this case, however, depended entirely on fuller use of the bulk truck. Mileage costs used in this comparison were based on 2 loads a day for all bulk trucks. If costs on the daily bulk route had been based on 1 trip a day they would not have dropped below can hauling costs within the volume range of the chart.

As the volume of milk collected per farm increases, the time spent by the bulk hauler at the farm is more efficiently utilized. As previously indicated this time does not increase in proportion to the quantity of milk loaded. To a considerable extent the same costs are spread over a greater volume of milk. This fact is primarily responsible for improvement in the relative cost position of bulk hauling as the volume of milk loaded per stop increases. In this connection note that every-other-day bulk pickup doubles the amount of milk picked up per stop. The farm stop time require-

On the farm, can hauling also involves much more physical effort than bulk hauling.

ment for a 400 pound per day producer on an every-other-day route is the same as that for an 800 pound producer on a daily bulk route.

If daily bulk service were provided producers averaging 70 pounds a day the hauler would spend about 10 minutes per hundredweight of milk at the farm. The every-other-day bulk truck would spend about 5 minutes and the can truck less than 3 for each hundredweight of milk.

When daily production is 630 pounds, the every-other-day bulk truck and the can truck each would spend less than 1 minute for each 100 pounds of milk loaded. The daily bulk truck would take about 1.5 minutes.

In this analysis the unit farm stop time on the daily bulk route was still higher than that of the can route when production per farm reached the 1,260 pound level. At volume levels in excess of 500 pounds, however, slightly higher time requirements on the daily bulk route were balanced by lower unit truck operating costs. Total daily bulk hauling costs thus fell below those on the can route at the higher volume levels.

Quite evidently the size of the producers served affected the advantage of bulk over can hauling. Potential reductions in hauling costs by use of bulk methods were greater on routes with large patrons than on routes of the same length serving small patrons. However, the rate of gain in every-other-day bulk hauling costs relative to can hauling costs was slight when daily volume per producer was more than 500 pounds.

On a route of average length, daily bulk hauling is likely to result in only slight reductions in hauling costs even when average daily production per patron is large.

Long Routes

Bulk hauling costs were lower compared to can hauling costs on long routes than on short routes.

As the length of a route was increased by remoteness of the pickup area from the plant, savings by both every-other-day and daily bulk hauling increased. An increase of 10 miles in the distance between the plant and the pickup area added 3.6 cents per hundredweight to the cost of hauling milk in cans. It added only 2.45 cents per hundredweight to costs on the bulk routes.

The saving in this case was entirely due to larger loads hauled by the bulk trucks. On the can route the costs of driving 20 additional miles was spread over 7,000 pounds of milk—on the bulk routes over 10,500 pounds.

Somewhat different results appeared when the length of the route increased due to greater distances between patrons in the pickup area. When routes increased in length for this reason, there was no change in the relationship between can and daily bulk hauling costs. The length of the route in each case increased proportionately as the size of the load increased. An increase in the distance between patrons, however, added only 50 percent as much mileage to the every-other-day bulk route as to the other types of routes.

For example, when 350 pound producers were 1 mile apart the daily bulk route traveled 30 pickup miles to serve 30 patrons a trip. An increase of 1 mile per patron increased the total distance traveled to obtain a 10,500 pound load by 30 miles. The every-other-day route by comparison served only 15 patrons per trip. An increase of 1 mile per patron per trip thus added only 15 miles to the distance necessary to obtain a 10,500 pound load.

Every-other-day route operations thus saved more miles on routes serving scattered patrons than on compact routes. Under the conditions described previously an increase of 1 mile per patron in the pickup area of a route serving 350 pound producers resulted in an increase of 1.8 cents per hundredweight of milk in the advantage of the every-other-day bulk route over daily bulk and can routes. For 700 pound patrons the gain was only .9 cents per hundredweight of milk.

Every-other-day bulk trucks can serve long routes with scattered patrons more economically than can trucks. However, bulk routes cannot serve scattered patrons as economically as patrons living in a small pickup area. Hauling costs on bulk and can routes both increase as length of route increases. The rate of increase in costs on the every-other-day bulk route is less than on a can route—but it is still an increase. In other words, although long routes are more practicable with bulk operations than with can operations, short routes are less costly under either system.

Applying Savings to Farm Tank Costs

How far will possible reductions in hauling costs go toward helping producers recover their investments in bulk farm tanks?

When hauling costs average between 20 and 25 cents a hundred pounds, a potential reduction of 4 to 5 cents is indeed significant to the average producer. If this saving was realized and reflected to producers directly in reduced hauling rates or indirectly as part of a premium for bulk milk, it would cover a large part of the investment in bulk cooling and storage equipment on the farm.

Cost of Farm Tank

To gain the advantage of bulk handling, the producer must first choose a suitable bulk tank and install it in his milk house. Table 1 shows approximate costs of bulk tanks for farmers producing 100 to 1,000 pounds of milk a day. Tanks included in this table would hold 1 or 2 days peak seasonal production, depending on the frequency of pickup, plus 20 percent extra capacity for possible increases due to herd expansion.

Prices in the table are averages of f. o. b. factory prices reported by dairy

Table 1.—Estimated investment in bulk farm tanks by size of producer

Average daily sales (pounds)	Peak daily milk sales [1] (pounds)	Size of tank required [2] (gallons)		Total cost of tank [3]		Annual cost [4]	
		Daily delivery	E. O. D.[5] delivery	Daily delivery	E. O. D.[5] delivery	Daily delivery	E. O. D.[5] delivery
100	140	60	60	$1,045	$970	$97	$91
200	280	60	100	1,045	1,318	97	123
300	420	100	150	1,448	1,607	135	150
400	560	100	200	1,448	1,992	135	186
500	700	100	200	1,448	1,992	135	186
600	840	150	200	1,700	1,992	159	186
700	980	150	300	1,700	2,354	159	220
800	1,120	200	400	2,153	2,615	200	244
900	1,260	200	400	2,153	2,615	200	244
1,000	1,400	200	400	2,153	2,615	200	244

[1] Allows for peak production 40 percent over daily average.
[2] To handle peak production plus 20 percent allowance for possible increase.
[3] Based on f. o. b. prices reported by manufacturers.
[4] Depreciation over a 15-year life plus 5 percent interest on undepreciated balance.
[5] E. O. D. indicates every-other-day delivery.

equipment manufacturers in the fall of 1954. It was assumed that discounts obtained would offset freight and installation costs. These prices cover complete units—cooling tank plus refrigeration unit and necessary supplemental equipment. Most manufacturers offer discounts when tanks are ordered in lots of 10 or more. Several cooperatives by buying in large lots have furnished tanks for their members at costs substantially below those listed.

Prices of tanks of the same capacity vary widely because of different style, type and size of refrigeration units, and materials used. Tanks for daily delivery require larger cooling units, because the volume of milk cooled at one time is greater, and accordingly cost more than the same capacity tanks for every-other-day delivery.

Yearly costs—depreciation over a 15-year period and interest at 5 percent on the undepreciated balance—varied from $91 to $244, depending on the size of the tank. The two columns at the right of the table show the range in the estimated annual costs. Although these costs are substantial they are not prohibitive when reduced to a per hundredweight basis and compared to potential savings in hauling costs.

Savings and Total Investment

Figures in table 2 show that potential savings in hauling costs cover a substantial part of the total bulk tank equipment costs when routes are operated on an every-other-day basis.

Estimated reductions in hauling costs used in this comparison are based on bulk trucks averaging 1.5 loads a day. We also assumed that the every-other-day operation resulted in only a 40 percent reduction in pickup mileage.

Equipment costs for producers on every-other-day pickup routes ranged from almost 25 cents a hundredweight for the 100 pound producer to less than 7 cents for the 1,000 pound producer. Estimated reductions in hauling costs with every-other-day bulk service ranged from a little over 1 cent per hundredweight for the 100 pound producer to almost 5 cents for the 1,000 pound producer.

Even at the 200 pound a day level

Table 2.—Bulk farm tank costs related to potential reduction in hauling costs

[Cents per hundredweight milk]

Average daily production	Cooling equipment costs			Estimated reduction in hauling costs[3]	Total bulk tank cost less hauling savings	Added cost for bulk tank less hauling savings
	Bulk tank[1]	Mechanical can[2]	Added costs for bulk tank			
			E. O. D.[4] bulk pickup			
Pounds						
100	24.9	13.4	11.5	1.2	23.7	10.3
200	16.8	7.5	9.3	3.5	13.3	5.8
300	13.7	6.1	7.6	4.0	9.7	3.6
400	12.7	5.5	7.2	4.3	8.4	2.9
500	10.2	5.3	4.9	4.5	5.7	.4
600	8.5	4.4	4.1	4.7	3.8	—.6
700	8.6	4.4	4.2	4.8	3.8	—.6
800	8.4	5.0	3.4	4.8	3.6	—1.4
900	7.4	4.8	2.6	4.9	2.5	—2.3
1,000	6.7	4.9	1.8	4.9	1.8	—3.1
			Daily bulk pickup			
100	26.6	13.4	13.2	None	26.6	13.2
200	13.3	7.5	5.8	None	13.3	5.8
300	12.3	6.1	6.2	None	12.3	6.2
400	9.2	5.5	3.7	None	9.2	3.7
500	7.4	5.3	2.1	None	7.4	2.1
600	7.3	4.4	2.9	None	7.3	2.9
700	6.2	4.4	1.8	None	6.2	1.8
800	6.8	5.0	1.8	.2	6.6	1.6
900	6.1	4.8	1.3	.4	5.7	.9
1,000	5.5	4.9	.6	.5	5.0	.1

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[1] Based on annual cost as calculated in table 1.

[2] Miller, Arthur H. *Economic Aspects of Bulk Milk Handling*, Unnumbered Memo paper—University of Wisconsin. Table 8, page 13.

[3] Based on assumption used in figure 1 except that bulk trucks average 1.5 loads per day and save 40 percent of can route pickup mileage when operated on an every other day basis.

[4] E. O. D. indicates every-other-day pickup.

potential savings over a 15-year period equaled about one-fifth of the investment. On routes serving patrons who averaged 1,000 pounds of milk a day, the estimated saving in hauling costs equaled nearly three-fourths of the cost of the producer's investment in the bulk farm tank. Thus over a 15-year period the reduction in hauling costs alone would repay the 1,000 pound producer for three-fourths of his investment in a bulk tank.

Daily bulk service in this case did not reduce hauling costs when producers averaged 700 pounds a day or less. Above the 700 pound level estimated reductions covered only a small part of the total investment.

Savings and Added Investment

Possible savings in hauling costs appear more impressive when compared with the added cost of the bulk equipment instead of with the total cost. In the long run, producers want to know whether savings from bulk milk handling will offset *added* equipment costs, not total equipment costs.

Producers have to bear the cost of cooling and holding milk on the farm whether it is handled in cans or bulk tanks. In the near future, many more producers of milk for fluid use will probably have to choose between mechanical can refrigeration and bulk refrigeration. More and more markets are requiring that milk be cooled to and held at temperatures of 50 degrees F. or less on the farm. In effect, this means mechanical refrigeration. In this case the added cost, not the total cost, of the bulk equipment is clearly the important factor.

Column 3 of table 2 shows estimated unit costs of equipment for mechanical refrigeration of milk in cans. These costs cover cans, can racks, and mechanical can cooling equipment. Column 4 shows the difference between the per hundredweight investments in bulk farm tanks and in mechanical can cooling equipment.

On every-other-day bulk routes with producers averaging 600 or more pounds a day, the estimated savings in hauling is greater than the added investment resulting from converting from cans to bulk tanks. Over a 15-year period the savings, if realized, would more than repay such producers for their entire added costs. The smaller savings from daily bulk service would cover a substantial part of the added costs when producers average 900 pounds or more milk a day.

The estimates of possible reductions in hauling costs are realistic under the conditions presented. However, possible savings would vary if the average volume per patron, length of route, size of loads hauled, wage rates, or truck operating costs differed from those used in this analysis.

Estimates of possible cost reductions used in table 2 cover only those from farm-to-plant hauling operations. They do not include savings from reduced losses of milk solids, improved quality, reduced receiving costs, or from other advantages of bulk collection. The two columns at the right of table 2 show the extent to which producers must rely on such other sources for savings to cover their investments in farm bulk tanks and related expenses, such as improving farm driveways and operating the cooling equipment from day to day.

If potential savings in bulk milk hauling revert to the producer, they will compensate him for a substantial part of his total investment in a bulk tank.

Coordination—A Challange to Management

Organization of a bulk milk procurement system on a plant or marketwide basis requires action by producers, haulers, and managements of marketing firms. Unless the actions of these various interests are coordinated, full realization of potential economies are unlikely. The task of providing the necessary coordination falls, in most cases, on the managements of the milk marketing organizations.

The broad array of problems management may face in working out a coordinated program are not considered here. An indication follows, however, of the nature of problems which are not likely to be solved by individual actions of producers, haulers or plants.

Advanced Planning

Bulk handling methods are not equally adaptable to all markets. Before a program to convert from cans to bulk tanks is started, the managements of marketing firms should investigate the practicability of bulk hauling operations in their local procurement area.

The shift from can to bulk methods may not be warranted in some cases, particularly in areas where production per farm is low. However, even in such areas many large producers are installing farm tanks. The managements of the marketing organizations involved cannot avoid dealing with the problem. Marketing cooperatives need not inaugurate conversion programs, but they should formulate progressive plans of action in anticipation of producers' demands for bulk service. Much can be lost if management is not prepared to supply services demanded by producers.

Maximum reductions in hauling costs will be achieved when entire routes and procurement areas are converted from can to bulk methods. Other studies have indicated that maximum reductions in receiving costs occur when receiving plants are converted to 100 percent bulk operation. Although 100 percent conversion of routes or plants cannot usually be attained in one step, conversions should be planned with these facts in mind.

Specific information regarding bulk route operating plans is essential to producers before they invest in bulk farm tanks. In some markets, every-other-day service cannot be practiced without revisions in health and sanitary regulations. As previously indicated, reductions in farm-to-plant hauling costs do not appear to be in the picture for average size producers in most markets unless every-other-day or less frequent service is practiced. When bulk trucks provide daily pickup service, savings from sources other than reductions in hauling costs must be relied upon to cover most of the added investment costs. Producers should be advised of this fact.

Producers also need information regarding frequency of pickup service as a guide in selecting the proper size of farm tank for their needs. Shifts from daily to every-other-day service or vice versa are generally impractical because of the comparative inflexibility of milk holding capacity on the farm.

Route Efficiency

Reorganization of milk procurement routes, when bulk trucks replace can trucks, opens the way for management to eliminate inefficiencies more or less characteristic of the present can system. Planned coordinated action can at least move in this direction. An unguided "Topsy like" growth of bulk routes could easily pile new inefficiencies on top of those carried over from the can system.

Efficiently organized and operated bulk routes are in general more economical than efficiently organized can routes. Many can routes, however, are not efficiently organized. Routes serving different plants in the same market, in some cases 2 or more routes serving the same plant, overlap. Many can trucks operate continuously with loads too small to be practicable. Well organized bulk routes replacing inefficient can routes could thus yield greater reductions in hauling costs than those estimated earlier.

When a bulk truck hauling a capacity load or a bulk truck serving all of the patrons of a plant in the route area replaces a can truck which has been hauling only half a load or serving part of the patrons in the area, real costs will decrease accordingly. Of course, similar economies could be made by reorganization of the can route system. Such opportunities have existed for years yet many route operators have not made the necessary adjustments.

Haphazard formation of bulk routes serving a few large producers who installed farm tanks early has been more or less typical in many market areas. This type of development will not result in maximum benefits to producers as a group. Not all such development can be avoided nor is it necessary that large producers put off installing bulk tanks and organizing bulk routes until all their neighbors are ready to convert. Much of the potential for reduced costs will be lost, however, if such bulk routes become permanent and are not adjustable as demands for bulk service in the area increase.

In actual practice patrons of a plant do not all adopt bulk methods at the same time. The shift to bulk methods involves a continuing organization of new bulk routes and reorganization of can routes to serve the remaining can producers.

For maximum reductions in receiving costs, cooperatives and other dairy plants should plan for complete conversion to bulk milk handling.

Flexibility in route organization is important during the conversion period. Unless the routing of trucks can be altered readily, a maze of high cost interweaving bulk routes will emerge.

Every effort should be made to attain a reasonable degree of flexibility either through ownership of trucks and routes or contracts with haulers. Bulk routes formed under contracts between individual producers and haulers are apt to be inflexible. Some cooperatives are attempting to provide the necessary control and flexibility in their bulk routes by buying truck tanks and leasing them to contract haulers who own and operate the trucks.

Bulk procurement can result in reduced hauling costs in most of our fluid milk procurement areas. Careful planning and skillful management can do much to assure that potential reductions in hauling costs become actual reductions in hauling rates to producers.

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